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Technology-based challenges of informal clinical communication in an Australian tertiary referral hospital: a survey-based assessment of user perspectives

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ABSTRACT

Background Clinical communication failures result in errors, misdiagnosis, inappropriate treatment and poor care. Communication errors contribute to sentinel events and are an underlying factor in healthcare system issues. Formal clinical communication (FCC) tools, such as ISBAR (Identify, Situation, Background, Assessment, Response/Recommendation), improve patient outcomes. FCC governance is focused on electronic medical records (EMRs); however, much informal clinical communication (ICC) occurs outside of the EMR.

ICC involves disparate platforms including pagers, SMS texts, encrypted messaging apps, phones and local radio networks. Documentation of ICC in the clinical record is low quality and not easily or routinely audited.

Local problem In 2019, our institution commenced a clinical governance assessment of ICC processes against version 2, Australian National Accreditation Standards for clinical communications. Process mapping of ICC indicated a paucity of relevant policy and procedures to govern ICC practices, with highly variable and overly complex processes.

Aims

1. To document the technology used in informal communication between clinical and/or administrative staff.
2. To document the self-perceived impact on staff of current communications methods.
3. To document the self-perceived potential efficiency and safety impact of current communications methods.
1. To identify key factors for consideration in organisation-wide informal clinical communication improvement.

Method Multidisciplinary online staff cross-sectional survey using Microsoft Forms.

Results 115 self-selected clinical and administrative staff completed the survey. Multiple communication channels are used for ICC. Respondents noted high levels of frustration, delay, interruption and inefficiency. Desired communication improvements and use considerations were identified.

Conclusions There are gaps in governance standards for ICC. Sequential additions to technology platforms contribute to a high-risk communications environment. Staff perceptions of inefficiency, delay, frustration and a high level of patient safety risk were consistent across professions. This work informed the requirements for a subsequent development of an enterprise platform dedicated to improving ICC.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Poor communication practice contributes to preventable errors or adverse events in patient care. Use of structured handover tools such as ISBAR provides a framework to improve formal clinical communication. Current multimodal, communication technologies for informal clinical communication (ICC) may be interruptive, inefficient, compound staff frustration and create potential for patient harm.

WHAT THIS STUDY ADDS

⇒ We assessed staff impressions of frustration, time wasting and potential for patient harm with existing multimodal communication technologies together with a framework for informal communication policy enhancement.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These findings provide a call for governance standards for ICC. We highlight the need for rationalisation of multimodal communication technologies to reduce communication complexity and identify some key functional requirements for new technologies.

INTRODUCTION

Problem description

Poor communication remains a leading cause of harm and poor patient experience within the hospital setting. Communication is a contributing factor in 70% of adverse events and has been identified as the most attributable root cause within 65% of sentinel patient events.[1 2]

Formal clinical communications (FCCs) such as structured clinical handover are promoted by safety and quality authorities and are accreditation requirements in Australia and internationally.[3] Use of a

	Standard 6 Communicating for Safety Clinical Communication Component	
Organisational Clinical Governance Element	Formal Clinical Communication (structured handover)	Informal Clinical Communication (ad hoc, continuous)
Clinical Policy	✓	✗
Clinical Procedure(s)	✓	✓
Standardised Practice	✓	✗
Clinical Audit Program	✓	✗
Monitoring & Reporting	✓	✗
Risk Analysis	✓	✗
Improvement Program	✓	✗

Figure 1 Comparison of compliance with proposed governance requirements for informal clinical communication (ICC) compared with formal clinical communication (FCC) in the version 2 ACQSH Australian national accreditation standards. Ref: National Safety and Quality Health Service Standards Guide for Hospitals V.2 pdf. Second Edition Australian Commission for Quality and Safety in Healthcare; 2017.

structured communication tool such as SBAR (Situation, Background, Assessment, Response/Recommendation) and ISBAR can significantly improve the quality and safety of clinical handover communications.[4] Informal clinical communication (ICC) is much less represented within accreditation requirements and published research.

Following the revision of the Australian Commission for Safety and Quality in Health Care (ACSQHC) version 2 (edition 1) accreditation requirements,[5] a significant gap in our institution's governance of clinical communication practice was suspected. There was a paucity of standards and process metrics for ICCs in the accreditation or governance literature.

A gap analysis was conducted by the hospital's clinical governance unit, whereby ICC processes were assessed against Australian clinical communication standards (ACSQHC standard 6–6.01, 6.02, 6.04, 6.09 and 6.10) (figure 1). While clinical handover (eg, shift to shift handover, ward rounds) had high levels of organisational governance and compliance with expected content, 'informal' communication was lacking in policy, procedure, structured tools and the ability to monitor and assess communication performance (online resources: online supplemental appendix 2).

Based on this assessment, further investigation was performed to better understand existing informal communication processes. Many communications occurring outside of structured clinical handover were ad hoc, inter-team and role-based in nature. When mapped across the organisation, inter-team, clinical communication practice was discovered to be overly complex and highly variable (figure 2), with two major issues identified. First, it was difficult for front-line clinicians to identify who was performing a specific clinical role at any given time. Second, there were multiple different communication methods available, and individual receiver preferences often dictated the method used. Such preferences may be known at switchboard but are not generally visible.

Investigations into preventable patient harm recognised decades ago that the care environment is a major factor in suboptimal human performance.[6] Communications technologies impact the practical processes of everyday communication but remain a relatively poorly studied component of the research. Hospitals adopt new communication platforms over time but may not rationalise or remove redundant technology. These disparate communication methods lead to inefficiencies and variations in practice. Comparison of five hospitals demonstrated significant differences in the benefits and unintended consequences between paging, SMS, phone and computer-based systems. All created interrupted workflows and potential for patient risk, and none offered solutions for all staff requirements.[7] Interruptions to clinical workflows have been associated with performance errors.[8–10]

Our process mapping indicated that communication technologies in use included paging, SMS, telephone calls to and from mobile (personal and hospital owned) and fixed telephone numbers, email, a variety of unsanctioned communication platforms such as WhatsApp and, more recently, Microsoft (MS) Teams. MS Teams had been introduced to general health service use in 2020 during the initial COVID-19 pandemic in our state but

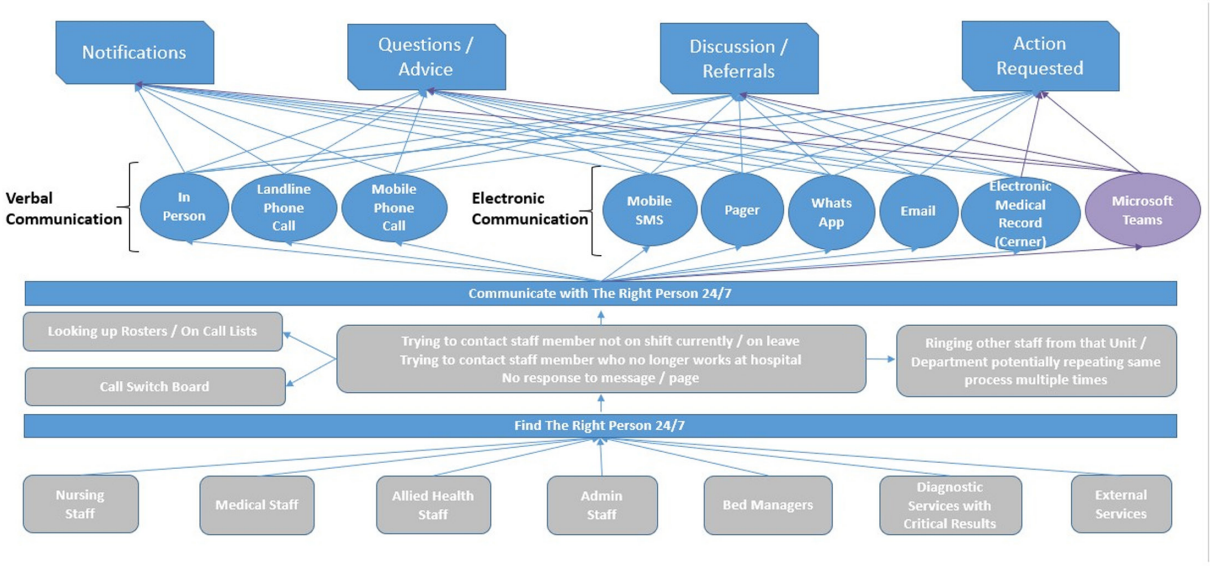

Figure 2 Patterns, purpose and technologies supporting informal clinical communications observed during health service wide Clinical Governance Communications Review in 2021. This investigation was performed prior to the survey. More detail is in the online resources.

was not initially configured as a clinical communication tool.

Some hospital-issued pagers and phones were specifically assigned to a person with an allocated senior role, and some were assigned to mid-ranking clinical roles and handed off between staff performing roles for which those devices were provided. However, many of these pagers were allocated to individuals whose role could change each term. Many registrars/fellows and consultants used personal mobile phones, although the hospital does allocate specific mobile phones for certain critical roles such as anaesthetist in charge of the operating rooms, referral intensive care unit registrar, cardiology registrar coordinating catheterisation suite. Many of these communication technologies are reliant on the parties knowing the name and contact details of the individual with whom they need to communicate. Some roles may be filled by multiple staff over a shift cycle. Each of these technologies offered benefits at the time of introduction, but no single platform could satisfy the requirements identified in the proposed ICC standard. The majority demonstrated high variation, poor documentation, poor visibility and accessibility, one-directional (asynchronous) communication and disruptive impact.

Improvements to the governance and day-to-day performance of ICC were deemed a 'Communicating for Safety' (ACSQHC Standard 6)[11] priority. To help inform a revision of the clinical communication framework and supporting technology, a survey of clinical staff was performed to validate the process map findings and understand the perceived impacts on clinician experience.

AIMS OF THE STUDY

1. To document the technology used in informal communication between clinical and/or administrative staff.
2. To document the self-perceived potential efficiency and safety impact of current communication methods.
3. To document the self-perceived impact on staff of current communication methods.
4. To identify key factors for consideration in organisational informal clinical communication improvement.

Setting

Our institution is a 1000 bed, three campus, tertiary/quaternary health service in Melbourne, Australia. There are approximately 5000 clinical staff. Clinical services include general and specialist surgery and medical services, emergency department, intensive care, liver, kidney and bone marrow transplant, cardiothoracic surgery, oncology, mental health.

METHODS

In 2019, the clinical governance unit instituted a review in relation to edition 1, version 2 of the Australian Council on Healthcare Standards national accreditation standards—2017 (online supplemental appendix 2—online resources). This review analysed existing policy, procedure, standardised practice tools and audit activities to identify gaps in the transition from version 1 to version 2 of the standards. The key issues identified in a gap analysis were incorporated into a survey tool (online supplemental appendix 1—online resources) seeking to estimate the nature and frequency of the technology platforms used for ICC. The cross-sectional voluntary staff survey was conducted in 2021 over a 3-month period. The survey tool asked users for estimated frequency of use, impact of technology and work practice required to identify the correct target person/role and the perceived impact of interruptions on patient safety and the respondent's work. Survey tools had specific fields for role delineation

(nursing, medical, allied health) but questions were otherwise identical across professions.

Multidisciplinary clinical and non-clinical staff in the pilot clinical units were invited by email and staff notices via MS Teams and paper wall posters to complete an electronic survey. The survey was a voluntary online MS Forms-based application. Staff roles, but not personal respondent identifiers, were retained. Only aggregated group summaries were analysed and reported.

The survey tool was developed by the senior project staff and was structured to identify user perceptions relating to their use of ICC technologies and the implications this had on their day-to-day professional tasks, patient safety and efficiency. It contained 15 questions asking respondents to select a standardised response or rate an item on a 5-point Likert scale. The survey is provided in online supplemental appendix 1 online resources.

In this study, clinical risk was not explicitly defined; however, the generally acknowledged definition in our hospital relates to any preventable adverse event impacting or potentially impacting patient well-being. Risks associated with interruptions and disruptions of clinical workflows include patient misidentification, medication error, overlooking of important information, failure to pass on critical information, failure to act in a timely manner. In this context, an interruption is an inbound communication request requiring a mental and/or physical response that shifts focus from the recipient's current task.

Survey data was collated and analysed using MS Excel, and data was downloaded from MS Forms as role-specific Excel spreadsheets which were amalgamated into a single table. Pivot charts and graphs were created. Responses were aggregated by groupings with more than five respondents per cell to protect respondent confidentiality. Reporting methodology was informed by the Consensus-Based Checklist for Reporting of Survey Studies criteria.[12]

There was no patient or public involvement in the project.

RESULTS

Staff survey

115 respondents completed the survey. 24 departments and 20 role categories were represented.

Respondent demographics were broad and included medical (prespecialty medical staff listed as intern/hospital medical officer, specialty trainee medical staff as registrar/fellow and senior medical staff as consultants), nursing, allied health, laboratory, radiology and administrative staff and are shown in table 1.

AIM 1: To document the technology used in informal communication between clinical and/or administrative staff.

Utilisation patterns of existing technology

Significant variation in the use of clinical communication platforms was reported (figure 3). Some roles had no access to clinical systems such as Oracle Cerner Millennium electronic medical record (EMR); however, all other options were available to all respondents. MS Teams had been implemented and was available for general administrative use. It was already being used informally for some clinical communications by many staff. SMS messaging was used by approximately one-third of respondents, as was the use of encrypted messaging services such as WhatsApp, despite the latter not being a hospital-endorsed communication platform. Hospital switchboard, LAN Page (desktop software application to send messages to pagers) and mobile phones were very significant. Asynchronous messaging communication via LAN Page was used frequently (multiple times per day) or commonly (everyday) by 38.3% of respondents.

AIM 2: To document the self-perceived potential efficiency and safety impact of current communications methods.

Efficiency and effectiveness of current methods

Find first time

Many respondents described difficulty in contacting relevant staff on the first attempt. 55 of 115 (47.8%) described inability to contact at first attempt more than 50% of the time. This may explain the continuing use of switchboard services to aid in finding the right person, as switchboard has access to the most accurate staffing rosters and is also able to redirect calls to covering clinicians as required (See On-line Supplementary Information table 2).

Potential time savings

Respondents believed they would save a significant amount of time each day if they were able to contact the right person on the first attempt (figure 4). 39/115 (33.9%) anticipated they would save between 30 and 60 min per day and 28/115 (24.3%) estimated time savings of over 1 hour per day. This could have significant follow-on implications for patient flow activities, if more timely discharge planning and additional clinic appointments could be achieved because of improved clinical communication efficiencies.

Response times

Respondents estimated timely (within 30 min) or reasonable (within 1 hour) response times 89/115 (77.4%) of the time.

Impact of time of day

52/115 respondents did not believe that there was a difference in terms of response times between the midnight and 12:00 compared with 12:01 and midnight. However, 32/115 described weekends and 18/115 described after hours as being a significant factor in their ability to contact the right person. The two cohorts reporting 'out of hours impacts' were bedside nurses and consultant medical staff.

AIM 3: To document the self-perceived impact on staff of current communications methods.

Table 1 Number of survey respondents by professional class and clinical department

Respondent department		Respondent roles	
Department	**Respondents (N)**		**Respondents (N)**
Ambulatory care centre	1	Assoc nurse unit manager	6
Anaesthesia	3	Bedside nurse	14
Cardiac ward 5 east	1	Nurse unit manager/liaison coordinator	5
Continuing care	1	Allied health practitioner	33
Emergency department	22	Radiographer	7
General medicine	5	Intern/HMO	4
Gynaecology	1	Registrar/fellow	12
Intensive care	9	Medical consultant	34
Laboratory	2		
Mental health	2		
Nutrition and dietetics	13		
Occupational therapy	12		
Oncology/palliative care	3		
Orthotics and prosthetics	2		
Paediatrics	1		
Physiotherapy	2		
Radiology/molecular diagnostics	17		
Renal	2		
Specialty medicine	6		
Speech pathology	4		
Spinal	1		
Subacute care dept	1		
Surgery	4		
Total	115	Total 115	

HMO is an abbreviation for hospital medical officer (generally year 2–4 postgraduation).

Clinical disruption by interruption

56/115 respondents described significant disruptions to clinical work related to incoming communication calls or messages. 19/115 (16.5%) reported between 10 and 20 interruptions per shift and 11/115 (9.6%) reported more than 20 interruptions per shift (figure 5).

Potential impacts of current communication methods were listed. Respondents were asked to agree or disagree with statements on a Likert scale. 90/115 (78%) of respondents agreed with respect to impacts on keeping track of communication and related actions, 93/115 (81%) agreed with missing communications, 86/115 (75%) agreed with no response to communication, 85/115 (75%) agreed with no documentation, 52/115 (45%) agreed with 3 points of identification not being used, 28/115 (28%) agreed that adverse events were more likely and 66/115 (57%) agreed that there was interruption to clinical tasks.

83% of respondents agreed that they did not consistently receive all required information more than 80% of the time. Missing important information included patient identifiers, 24/115 (21%), call back and return information 23/115 (20%), identification of initiator 20/115 (19%), nature of problem 25/115 (22%), acknowledgement of request 8/115 (7%). 20% of respondents, 23/115, reported being the incorrect recipient of a clinical communication at least once per day.

Documentation of the communication

Only 20 of 115 (17.4%) respondents believed that the current communications tools provided adequate documentation of the interaction. This finding is consistent with prior governance concerns regarding poor documentation discovered during audits of clinical incidents.

Additional tables are available in the online resources.

DISCUSSION

The imperative to improve clinical communication is well recognised by Australian and international health and quality of care agencies. FCC methods, such as clinical handover, are widely promoted by safety and quality authorities, and accreditation systems are designed to improve safety in the transfer of critical information.[11 13]

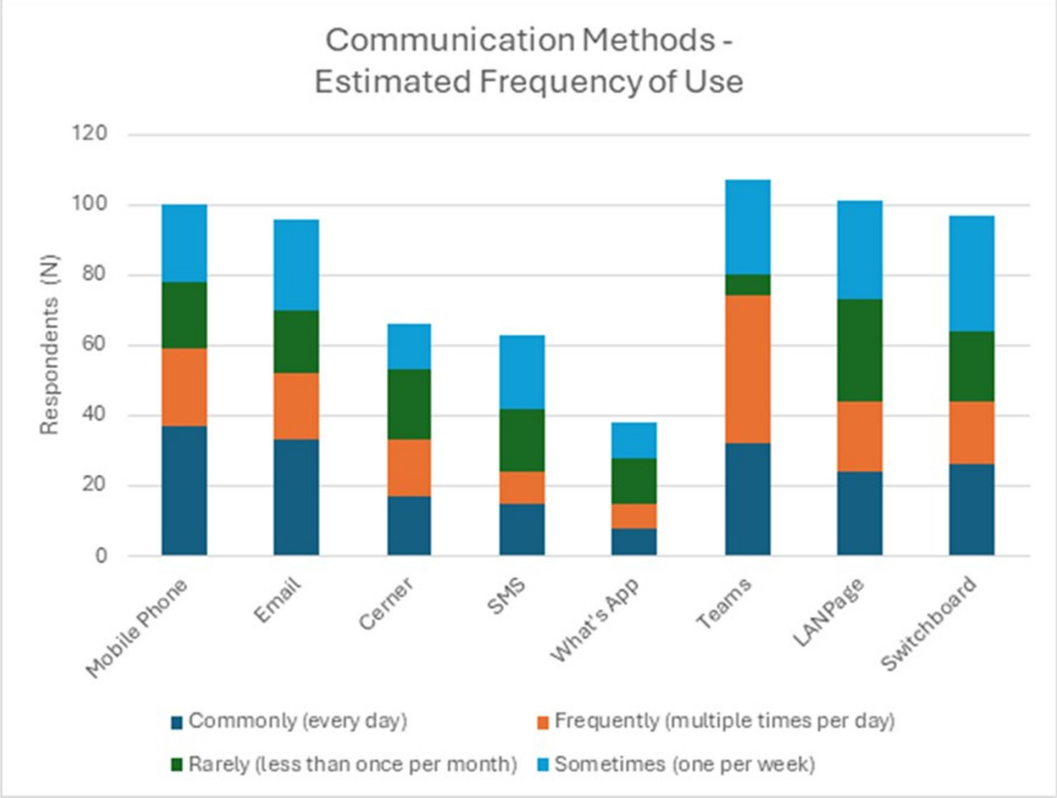

Figure 3 Respondent reported estimated frequency of use of communication technologies. Teams refers to Microsoft Teams (R), LAN Page is a desktop computer App enabling messages to be sent to pagers.

Structured handover communication tools such as SBAR and ISBAR content models provide a clear framework for clinical communication to reduce the likelihood of information gaps in specific circumstances and help ensure key information is included in the transfer of information between clinicians.[14 15]

Clinical practice relies on individuals fulfilling professional roles. Each role may be filled by different individuals across shifts, each 24 hours, days of the week and as training positions change during the year(s). Our survey has shown that rapid and reliable identification and contacting of the person fulfilling a given role

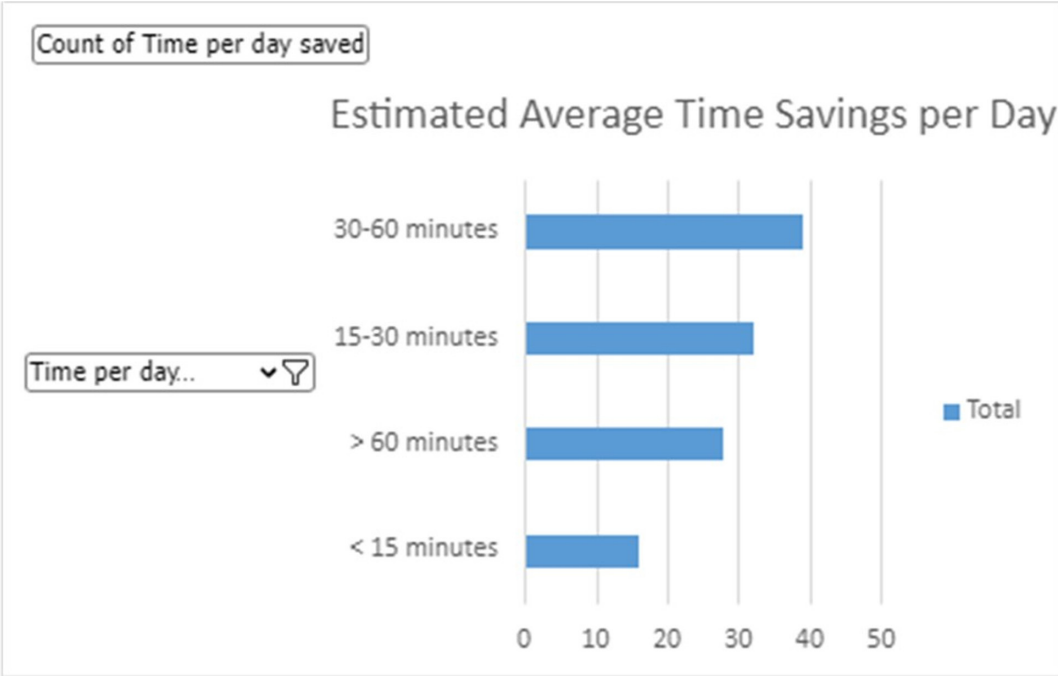

Figure 4 Perceived estimates of time saving if the required person was identified and contacted on the first attempt.

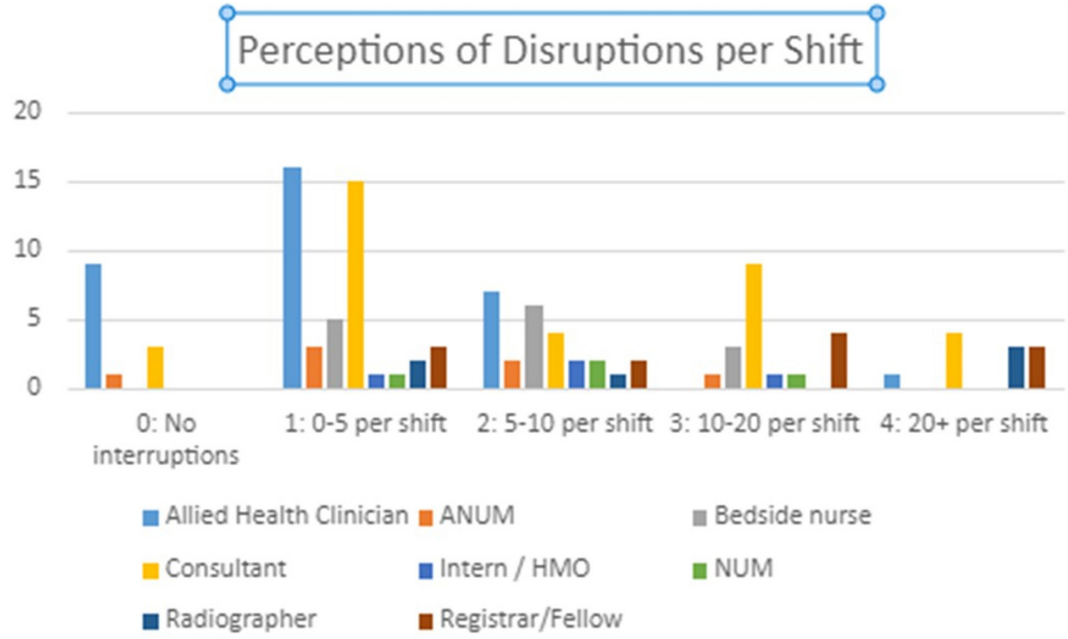

Figure 5 Perceptions of average interruption frequency per shift by professional group. No assumptions are made regarding the appropriateness of the disruption. ANUM, associate nurse unit manager; HMO, hospital medical officer; NUM, nurse unit manager.

can be complex, time-consuming and frustrating. ICC involves high-volume, ad hoc and unstructured communication processes such as in-person conversations, pages, phone calls, role-based wireless communications devices (eg, Vocera[16]) and electronic messaging via personal or hospital-provided smart devices across the 24-hour clinical care environment.[17] These communication systems have been introduced over many decades and reflect 'state of the art' technology capabilities of their era. These technologies, once introduced, retain utility in certain sociotechnical contexts and are rarely removed. Australian accreditation schemes contain limited assessment of ICC processes and do not address communication at a technology level, despite clinical communication research demonstrating both negative and positive impacts of specific clinical communication methods. Most studies focus on one modality in a single clinical context when the modality is introduced rather than the impact of composite systems at institutional level.[18–22]

Sociotechnical frameworks for information and communications technology (ICT) implementations have been proposed[23] and recommendations for the safe use of technology identified,[24] although these largely focus on EMR-based communications and design. There have been far fewer publications describing the impact of communication technology on the safe delivery of clinical care, workforce satisfaction, clinician frustration and burnout. Those publications which do exist highlight differences between synchronous and asynchronous tools, the differences in use cases, clinician preference for modalities and the high burden of use. Synchronous communications provide most information density and interaction but are the most interruptive.[25] While there are many publications on 'clinical burnout' related to the EMR, and some on a single communication method, there are limited publications regarding the impact of multimodal communication technology.[26] Studies in non-health workplaces demonstrate potential negative impacts of social media use on staff performance and well-being.[27]

Through our earlier assessment of ICC practice, high variability was identified outside of formal structured handover processes. This assessment highlighted four major classifications of informal multidisciplinary communication (figure 2 and online resources)—Notifications, Questions and Advice, Referrals—Discussion and Action Requests. Similar classifications of clinical communication have been previously described in an analysis of junior medical staff task management activity.[28] A variety of technology platforms were in use, including paging, SMS, fixed line telephone calls, mobile phone calls, email, a variety of unsanctioned communication platforms such as WhatsApp and, more recently, MS Teams. The assessment also demonstrated a paucity of auditable documentation related to 3-point patient identification requirements, issues discussed and actions performed.

Through this staff survey, we confirmed the range of clinical communication technologies currently in use and identified a range of issues associated with this complex multimodality communication system. Issues identified with existing communication technologies related to communication timeliness, communication quality and disruption to clinical care delivery. The associated patient safety risks and potential impacts are in alignment with existing communication research evidence, relating to paging and phone communication technology.[9 25 29–31]

44% of respondents reported inability to make contact at first attempt more than 50% of the time. Survey results indicated approximately 18% of all communications receive poor-to-no response at all. 58.2% of respondents believed they would save significant amounts of time each day (>30 min) if they were able to contact the right clinician on first attempt. 38% of respondents use switchboard commonly or frequently, suggesting that the identification of the correct person to, or modality for, contact may be difficult. This is consistent with the challenges identifying correct personnel in emergency departments and supports the concept of role-based communications.[32]

Despite advancements in electronic communication tools, the ongoing use of text (alphanumeric) paging for clinical care delivery remained considerable (38% respondents). The reported impact of the use of pagers aligns with studies which highlighted the inefficiency associated with poor visibility and inaccuracy of pager allocations. Significant limitations in real-time communication occur using paging technology in an acute care setting.[18 19] Use of pagers raised concerns from a communication timeliness and communication quality perspectives, as key information is often omitted.

Only 11% of survey respondents believed that they received all required information during ICC more than 80% of the time. Most survey respondents (82%) identified missing communication as having a potential negative impact on workflows and efficiencies of care. Lack of patient identifiers, call back/return information, sender information and description of the nature of the problem were cited as issues in the quality of electronic communication performed. Text paging has been found to lack clarity, contain poor messaging structure and have high variability of messaging content.[19]

Many clinical services used alphanumeric pagers, but not all pagers are allocated to specific clinical roles. Cognitive overload is common in large, complex healthcare settings, and pager-based interruptions have been identified as one cause.[29] The number and variety of interruptive communications that occur contribute to cognitive overload, frustration and error. A multihospital incident reporting system showed 220 potentially harmful incidents related to 'interruption' and 'distraction'; almost 10% of these were technology related. Phone calls have also been identified as a common interruption to the delivery of clinical care,[26 33 34] with interruptions in the performance of clinical tasks a contributing factor in specific adverse patient events including medication errors and procedure failures.[9 35 36]

Phone calls via mobile (51.3% respondents) and fixed lines (42.6% respondents) were a predominant form of clinical communication.

48.7% of respondents described significant interruptions. 16.5% of respondents reported 10–20 interruptions per shift and 9.6% of respondents reported more than 20 interruptions per shift. This data is consistent with international findings,[34] although our self-reported interruptions, despite being significant in frequency and impact, are somewhat fewer than other reports. 69.6% of respondents identified interruption to the performance of clinical tasks as a potential negative impact of existing communication technologies.

The balance between interruption frequency and the essential requirement for that communication is a critical one. The need for timely communication in care management, for example, referrals, escalation of care,[37] medication requests,[10] communication of important laboratory and radiology[34] results, discharge planning,[38] sits on one side of the risk equation. On the receiver side of the communications, the potential for interruptions to cause medication errors,[10] failure to complete tasks,[8] distraction during physical procedures and investigation results reporting[34] pose increased clinical risk.[9] Multitasking has become a normal and important practical capability but clearly has risks of cognitive overload and performance degradation. Humans have the capability to perform subconscious automatic behaviours enabling ongoing tasks while conscious concentration on other non-routine tasks. Driving a vehicle is one such subconscious activity. However, interruptions to conscious attention by phone calls or texting while driving can have disastrous consequences[39] (quoted in a study by Bannister and Remenyi.[40]). Noise in the operating room may have deleterious impacts on operating room staff[41] . Working memory relates to the number of items that can be recalled from a list and indicates task processing capacity. Executive attention controls the elements that are placed in working memory and can actively block the addition of new elements. Increasing inputs to both elements of the memory can overload it and lead to loss of focus and forgetting.[42] Even though both sender and receiver may acknowledge the importance and validity of a particular message, the impact of the interrupted task may still be detrimental to the 'interrupted' patient. Minimising interruptions has benefits for both callers and recipients of communications by reducing time waiting for responses or responding to calls, time may be reallocated to other care tasks. Ensuring that all predictable tasks are completed during rounds, that patient care plans are clearly documented and discussed with ward staff, and that medications and investigation orders are preplanned where possible and clearly documented reduces the need for ad hoc calls at a later time.[43 44] Cognitive and emotional stresses on medical staff are well documented, and interruptions are at least contributory. The National Academies of Science report[45] into Clinician Burnout provides a well-balanced review of the impact of interruptions to work flow and chaotic workplaces. Not all communications have the same urgency or criticality. SMS and alphanumeric pager messages content may indicate urgency of response, but this is not possible for telephone calls. As multiple technical communication modalities are operating simultaneously, it is possible for SMS messages to interrupt phone calls, thus further increasing complexity.

While small in sample size, this study was consistent with the findings of our earlier clinical governance-based

analysis of the ICC framework. The high complexity and high variability in the performance of ICC, with an evolved, rather than designed, organisational technology stack, involving numerous communication methods, was confirmed by survey participants. Clinician perceptions of patient safety risks potentially attributable to ICC practice were confirmed.

Simplification of ICC requires identification of the correct person with whom to communicate. The allocation of specific, structurally stable clinical roles enables consistency of approach and process regardless of which person is allocated to that role in each work shift. This may reduce delays identifying and contacting the person in that role. The concept of roles at a more generalised level suggests that different roles may benefit from different communication tools.[46] In this model of team roles—innovator, resource investigator, chair, shaper, evaluator, team worker, organiser, finisher may have functional representations (in a health service sense) in roles such as consultant, registrar, intern, nurse, administrative support, nurse co-ordinator or unit manager. These functional roles may be present in all professional group teams or multiprofessional teams. Our findings suggest that each of these cohorts may have preferences for different tools, and this has implications for the design and function of any future enterprise system purporting to reduce the number of modalities in use.

The need for our institution to look beyond structured FCC processes, review ICC governance from a holistic system perspective and consider communication technology as a fundamental component of clinical governance for patient care was confirmed by this study. Survey results indicated that the existing clinical communication framework should be reviewed as an environmental factor that could be negatively impacting on staff role-satisfaction, well-being and burnout. Experiential feedback provided by frontline clinicians, including the level of use of each communication technology, as well as variations in technology use across different clinical disciplines, is required for critical insight to guide and prioritise future system improvements.

AIM 4: Our fourth aim was to identify key factors for improvement of informal communication with respect to improved clinician experience, efficiency and the quality of clinical documentation. We believe the survey results imply that:

1. A readily accessible communications platform for all staff should be available and always current.
2. Staff should be allocated to their functional role on a shift-by-shift basis.
3. The person performing each role should be readily identifiable.
4. A single platform would be ideal.
5. Indication of the urgency of response time enables prioritisation of respondent's time and tasks and helps align caller and respondent priorities.
6. A documentation thread should be maintained so all appropriate staff can see the issues and actions arising.
7. Patient identification data compliant with standards requirements (eg, 3-point identification) should be explicitly visible in the thread.
8. Reduction of the numerous potentially redundant communications technologies should be undertaken when possible.

Strengths of study

Our study documents the perceived frequency and impact of multimodality communications practices in a tertiary/quaternary public hospital in Victoria, Australia. It is broadly representative of many other Australian and international hospitals in the nature of the communications requirements and uses technology provided by international vendors for clinical communication. The literature supports our findings with respect to the impact of unstructured communications and multiple technology platforms on clinical inefficiency, interruptions and potential clinical errors. The survey respondents represented a wide variety of roles and levels of clinical responsibility, were self-selected to respond and were therefore motivated to share information they thought was important. The study confirms the range of clinical communication technology in use by frontline clinicians, validating the health service's clinical governance-based assessment of the existing communication framework. Our findings on the impact of existing clinical communication technologies in use, and the risk of high variation in clinical practice, are consistent with those reported in both Australian and international literature. The study forms an important baseline of current ICC practices in the context of the ever-increasing availability of new communication platforms and applications. We document the need to look beyond structured clinical handover to improve the safety of clinical communication practice and reduce the potential for communication-associated patient harm. The cumulative impact of multimodal ICT on interruption type and frequency is also observed. We also identify the predominantly role-based nature of ICC practice that requires technological change for greater efficiency. This study confirms the need to formalise ICC governance models and rationalise technology to reduce impacts and risks of multiple concurrent communication methods.

Weaknesses of study

The overall number of respondents (115) was smaller than anticipated and is a small proportion of the approximately 5000 clinical staff employed at the health service over three campuses, only one of which was involved in the survey. This may reflect that the impending pilot was to be conducted in a small number of clinical units in which the affected staff would have numbered approximately less than 1000. Hence, the response rate may have been closer to 10% of relevant staff. The proportions of survey respondent roles may not be representative of the mix of roles in the relevant workforce; however, medical staff, allied health, radiographers and liaison nurses who are highly dependent on ICC technologies were

well represented in survey responses. The self-selection process may have inadvertently biased reporting. Reporting was subjective, and there were no independent observational or time in motion validations of personal perceptions regarding the number of communications occurring in each respondent group, nor the impact on individual respondents. The justification for the interruption is not documented. Definition and measurement of justification is challenging as it may differ based on sender or receivers' perceptions. At the time of the survey, the focus was on the number of interruptions as perceived by the receiver rather than the validity of the interruption. Validity was implicitly accepted by the authors and therefore was not specifically investigated. Better understanding the reasons for the calls may have added value to the study. The survey methodology asked for perceptions regarding the average frequency of events and did not report detail regarding the content of the communication. Respondents' perceptions are potentially heuristically biased by recent versus distant experience. Although the communications systems in use are provided by multinational corporations and are part of international product suites, other hospitals may use them differently than in our hospital. Hospital cultures and communications norms vary across organisations and countries and so may not be representative in all hospitals. The rapid implementation of MS Teams (around the time of the COVID-19 pandemic) without clear guidance regarding use for clinical care or 'rules of engagement' in place may have biased the experience of this platform for some clinicians. Issues related to training in communication methodologies rely on having appropriate policies in place (the governance process identified such issues) and staff compliance with training and policies. Both the rapid implementation and lack of training may have been associated with poor and inefficient practice but were out of scope with this survey. Staff may have overestimated or underestimated the potential time savings they could achieve if they were able to contact the right person on the first attempt.

CONCLUSIONS

Improving ICC to enhance patient safety, clinical documentation and user efficiency requires more attention to matching technology, context and clinical practice.

Our multiple hospital ICT systems supporting ICC enable variations in practice, including personal preferences, to occur. While the health system could not function without these communication modalities, the multiple layers of technology may contribute to inefficiency, delay, clinician frustration, paucity of documentation, incompleteness of information content and unnecessary interruption to clinical care.

This study details clinician experience and perceptions of clinical risk associated with the use of multiple ICC platforms. The data confirms the international experience of users in multimodality, complex communications environments. The survey findings reflected and validated the policy gaps identified in our prior clinical governance assessment of ICC practice.

This study contributed to the design and user requirements specification for a simplified, single platform enterprise communications system 'Baret Role Based Communicator' using MS Teams technology that was implemented during 2021–2023. This application was developed to create a platform enabling users to log in and out of predefined roles according to their rostered shifts. Other users contact them using their role through the Baret application using messaging or voice calls (including multiple participants) by other staff. Message threads can be viewed easily by later shifts logged onto those roles and by supervisors, enabling both better continuity of care and audit. There is a full audit trail, and metadata can be downloaded for analysis and research. A data visualisation application allows workloads to be monitored. Many teams have completely discarded their pagers. The development and implementation of the application will be published elsewhere.

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REFERENCES

1 Commission TJ. Sentinel event data 2022 annual review. Oakbrook Terrace, IL 60181, 2023.
2 Guttman OT, Lazzara EH, Keebler JR, *et al*. Dissecting Communication Barriers in Healthcare: A Path to Enhancing Communication Resiliency, Reliability, and Patient Safety. *J Patient Saf* 2021;17:e1465–71.
3 Beament T, Ewens B, Wilcox S, *et al*. A collaborative approach to the implementation of a structured clinical handover tool (iSoBAR), within a hospital setting in metropolitan Western Australian: A mixed methods study. *Nurse Educ Pract* 2018;33:107–13.
4 Burgess A, van Diggele C, Roberts C, *et al*. Teaching clinical handover with ISBAR. *BMC Med Educ* 2020;20:459.
5 ACoSaQiH C. National-safety-and-quality-health-service-standards-guide-for-hospitals v2.pdf. In: *Australian commission on safety and quality in health care*. 2017.
6 Vincent C, Taylor-Adams S, Stanhope N. Framework for analysing risk and safety in clinical medicine. *BMJ* 1998;316:1154–7.
7 Wu RC, Lo V, Morra D, *et al*. The intended and unintended consequences of communication systems on general internal medicine inpatient care delivery: a prospective observational case study of five teaching hospitals. *J Am Med Inform Assoc* 2013;20:766–77.
8 Westbrook JI, Coiera E, Dunsmuir WTM, *et al*. The impact of interruptions on clinical task completion. *Qual Saf Health Care* 2010;19:284–9.
9 Westbrook JI, Raban MZ, Walter SR, *et al*. Task errors by emergency physicians are associated with interruptions, multitasking, fatigue and working memory capacity: a prospective, direct observation study. *BMJ Qual Saf* 2018;27:655–63.
10 Westbrook JI, Woods A, Rob MI, *et al*. Association of interruptions with an increased risk and severity of medication administration errors. *Arch Intern Med* 2010;170:683–90.
11 Healthcare ACfSaQi. Australian commission for safety and quality in healthcare. 2023. Available: https://www.safetyandquality.gov.au/standards/nsqhs-standards/communicating-safety-standard
12 Sharma A, Minh Duc NT, Luu Lam Thang T, *et al*. A Consensus-Based Checklist for Reporting of Survey Studies (CROSS). *J Gen Intern Med* 2021;36:3179–87.
13 Dietz AS, Pronovost PJ, Mendez-Tellez PA, *et al*. A systematic review of teamwork in the intensive care unit: what do we know about teamwork, team tasks, and improvement strategies? *J Crit Care* 2014;29:908–14.
14 Müller M, Jürgens J, Redaèlli M, *et al*. Impact of the communication and patient hand-off tool SBAR on patient safety: a systematic review. *BMJ Open* 2018;8:e022202.
15 De Meester K, Verspuy M, Monsieurs KG, *et al*. SBAR improves nurse-physician communication and reduces unexpected death: a pre and post intervention study. *Resuscitation* 2013;84:1192–6.
16 Stryker. Stryker corporate web site. Available: https://www.stryker.com/us/en/portfolios/medical-surgical-equipment/clinical-communication-and-workflow/hardware.html [Accessed 16 Apr 2025].
17 Johnson M, Sanchez P, Langdon R, *et al*. The impact of interruptions on medication errors in hospitals: an observational study of nurses. *J Nurs Manag* 2017;25:498–507.
18 Brady A-M, Byrne G, Quirke MB, *et al*. Barriers to effective, safe communication and workflow between nurses and non-consultant hospital doctors during out-of-hours. *Int J Qual Health Care* 2017;29:929–34.
19 Luxenberg A, Chan B, Khanna R, *et al*. Efficiency and Interpretability of Text Paging Communication for Medical Inpatients: A Mixed-Methods Analysis. *JAMA Intern Med* 2017;177:1218–20.
20 Ferguson A, Aaronson B, Anuradhika A. Inbox Messaging: an effective tool for minimizing non-urgent paging related interruptions in hospital medicine provider workflow. *BMJ Qual Improv Rep* 2016;5:u215856.w7316.
21 Smith CNC, Quan SD, Morra D, *et al*. Understanding interprofessional communication: a content analysis of email communications between doctors and nurses. *Appl Clin Inform* 2012;3:38–51.
22 Coiera E, Tombs V. Communication behaviours in a hospital setting: an observational study. *BMJ* 1998;316:673–6.
23 Sittig DF, Singh H. A new sociotechnical model for studying health information technology in complex adaptive healthcare systems. *Qual Saf Health Care* 2010;19 Suppl 3:i68–74.
24 Group PSA. *Safe use of technology*. Joint Commission, 2015.
25 Popovici I, Morita PP, Doran D, *et al*. Technological aspects of hospital communication challenges: an observational study. *Int J Qual Health Care* 2015;27:183–8.
26 Kellogg KM, Puthumana JS, Fong A, *et al*. Understanding the Types and Effects of Clinical Interruptions and Distractions Recorded in a Multihospital Patient Safety Reporting System. *J Patient Saf* 2021;17:e1394–400.
27 Yu L, Cao X, Liu Z, *et al*. Excessive social media use at work. *ITP* 2018;31:1091–112.
28 Hettiachchi D, Hayes L, Goncalves J, *et al*. Team Dynamics in Hospital Workflows: An Exploratory Study of a Smartphone Task Manager. *JMIR Med Inform* 2021;9:e28245.
29 Manojlovich M, Harrod M, Hofer TP, *et al*. Using Qualitative Methods to Explore Communication Practices in the Context of Patient Care Rounds on General Care Units. *J Gen Intern Med* 2020;35:839–45.
30 Yu J-P, Kansagra AP, Mongan J. The Radiologist's Workflow Environment: Evaluation of Disruptors and Potential Implications. *J Am Coll Radiol* 2014;11:589–93.
31 Schamroth J, Pettit W, Yarlott L, *et al*. Connecting the hospital using "Forward", a smartphone application for clinical teams. *Future Healthc J* 2019;6:67.
32 Lee S, Tang C, Park SY, *et al*. Loosely formed patient care teams: communication challenges and technology design. CSCW '12: Proceedings of the ACM conference on Computer Supported Cooperative Work; 11 Feb 2012; 2012:867–76.
33 Khairat S, Whitt S, Craven CK, *et al*. Investigating the Impact of Intensive Care Unit Interruptions on Patient Safety Events and Electronic Health Records Use: An Observational Study. *J Patient Saf* 2021;17:e321–6.
34 Kansagra AP, Liu K, Yu J-P. Disruption of Radiologist Workflow. *Curr Probl Diagn Radiol* 2016;45:101–6.
35 Santomauro C, Powell M, Davis C, *et al*. Interruptions to Intensive Care Nurses and Clinical Errors and Procedural Failures: A Controlled Study of Causal Connection. *J Patient Saf* 2021;17:e1433–40.
36 Schroers G, Ross JG, Moriarty H. Nurses' Perceived Causes of Medication Administration Errors: A Qualitative Systematic Review. *Jt Comm J Qual Patient Saf* 2020;47:38–53.
37 Jones D, Bellomo R, Bates S, *et al*. Patient monitoring and the timing of cardiac arrests and medical emergency team calls in a teaching hospital. *Intensive Care Med* 2006;32:1352–6.
38 Sharma G, Wong D, Arnaoutakis DJ, *et al*. Systematic identification and management of barriers to vascular surgery patient discharge time of day. *J Vasc Surg* 2017;65:172–8.
39 Accidents RSftPo. Driver distraction. 2008.
40 Bannister F, Remenyi D. Multitasking: the uncertain impact of technology on knowledge workers and Managers. The Electronic Journal Information Systems Evaluation. 2009.1–12.
41 Mcleod R, Myint-Wilks L, Davies SE, *et al*. The impact of noise in the operating theatre: a review of the evidence. *Ann R Coll Surg Engl* 2021;103:83–7.
42 Britannica T. Memory: encyclopedia britannica. 2025. Available: https://www.britannica.com/science/memory-psychology
43 Blakeney EA-R, Chu F, White AA, *et al*. A scoping review of new implementations of interprofessional bedside rounding models to improve teamwork, care, and outcomes in hospitals. *J Interprof Care* 2024;38:411–26.
44 Gonzalo JD, Himes J, McGillen B, *et al*. Interprofessional collaborative care characteristics and the occurrence of bedside interprofessional rounds: a cross-sectional analysis. *BMC Health Serv Res* 2016;16:459.
45 National Academies of Sciences E, and Medicine. Taking action. taking action against clinician burnout. Washington, DC The National Academies Press; 2019.
46 Michailidis A, Rada R. Organizational roles and communication modes in team work. Hawaii International Conference on System Sciences. HICSS-34; Maui, HI, USA, 2001:9.